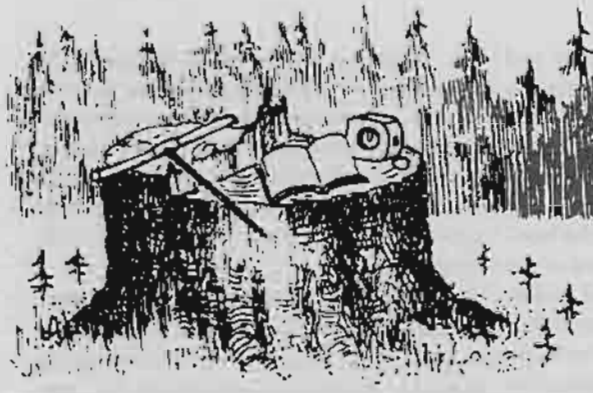

JDSF Newsletter

Jackson Demonstration State Forest

No. 48 Summer 1994

Hardwood Management and Utilization Demonstration Workshop Held on Jackson Demonstration State Forest[1]

An informative and interesting day was enjoyed by all folks who participated in the hardwood workshop held near Parlin Fork Conservation Camp on Jackson Demonstration State Forest (JDSF) last September. The workshop was directed at helping to develop interest in managing and using north coast hardwoods. The workshop idea was initiated by Forest Tilley, a former forest manager of the state forest who is now involved with a local group promoting development of markets for northcoast-hardwoods.

The workshop was organized with six specific topics for demonstration and discussion. These were 1) Landowner management of hardwoods; 2) Bucking logs for value; 3) Low impact skidding and hazard reduction with an ATV and arch; 4) Milling hardwood logs with a portable mill; 5) Hardwood grading; and 6) some low cost lumber drying options.

The success of the workshop was due to the involvement of many people (Jim Lipke logging engineer with the U.S. Forest Service, Jack Boone a portable sawmill owner, Greg Downer an owner of a hardwood lumber supply company, Forest Tilley and Jim Anderson, CDF chief at Parlin Fork Conservation Camp and manager of the sawmill and lumber drying facility there .

The site selected for the workshop was near the Parlin Fork Conservation Camp. This site allowed discussion of the management of the hardwood component of the forests found on the coast by providing an actual management scheme for discussion. Also the site provided an opportunity to show the ATV yarder and a portable sawmill in operation. The sawmill and drying kilns at the Conservation Camp provided further opportunities to discuss hardwood grading and recovery.

Hardwood Management

Managing the hardwood resource presents a challenge for timberland owners and managers. Hardwoods can hinder conifer regeneration and stand growth yet from a wildlife habitat perspective, hardwoods in a redwood dominated ecosystem also provides some of the most diverse and rich habitat of all cover types. The management of the hardwood component focused on several areas of discussion: leaving sufficient numbers, types and sizes of hardwoods to maintain and improve wildlife habitat, and improve the quality of the hardwood trees in the stand. The criteria Jim uses for selection of immediate hardwood sawlog harvest trees are those trees 12" DBH or greater which have at least one good log 8' to 12' in length. Trees having some defect or poor form but still having at least one good log are removed also to provide for stand improvement. The leave trees marked for future harvest should be well spaced and have straight, well-developed stems and crowns with few limbs. Some occasional sweep or crooks are acceptable. The goal is to promote larger boles containing a higher percentage of clear grades of lumber. To enhance wildlife habitat stand characteristics, some trees are also retained which have bole cavities, many branches and other form characteristics that proThe objective is to mark trees for both present and future harvests that will maintain and enhance the productivity of the stand. Criteria for selection of immediate hardwood sawlog harvest trees are those trees 12" DBH or greater which have at least on good log 8' to 12' in length. Trees having some defect or poor form but still having at least one good log are removed also to provide for stand improvement. The leave trees marked for future harvest should be well spaced and have straight, well-developed stems and crowns with few limbs. Some occasional sweep or crooks are acceptable. The goal is to promote larger boles containing a higher percentage of clear grades of lumber. To enhance wild-

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CALIFORNIA DEPARTMENT OF FORESTRY AND FIRE PROTECTION

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life habitat stand characteristics, some trees are also retained which have bole cavities, many branches and other form characteristics that provide roosting and nesting opportunities.

Grade and Recovery

There was discussion on bucking considerations and other log treatments following the felling process. One problem identified in developing a market for western hardwoods are the restrictions current hardwood grading rules place on grade recovery. The National Hardwood Lumber Association (NHLA) grading rules are considered standard for the hardwood lumber industry nationwide, but many local mill operators feel these rules are not appropriate for the local hardwood species Some individuals are advocating the development of cottage industries that can utilize the local hardwoods and thereby overcome current grading system limits.

Greg Downer presented some important points to consider when processing trees to maximize grade recovery. His major points were: 1) immediately treating the fresh cut ends of logs and lumber to equalize the drying rate and therefore minimize checking, and 2) in milling logs make cuts perpendicular to the log axis so that log face meets grade length minimum.

THE ATV-LIPFOOT ARCH YARDING SYSTEM

Next up on the workshop agenda was a demonstration of hardwood log yarding from the felling site to the landing. Jim Lipke brought his ATV (All Terrain Vehicle)-logging arch based yarding system that he co-developed with Chuck Linfoot - hence the name Lipfoot Arch(fig 2.). A Kawasaki 4x4 ATV was used for the demonstration which Jim considers a very durable machine, having an excellent turning radius. The tires are filled with antifreeze to increase the unit weight thus improving traction and lowering the center of gravity of the ATV. The ATV and arch unit weighs in at approximately 1200 pounds. A rear mounted steel rack is used to carry a battery that powers the 8000 pound rated winch mounted on the arch. Although bigger than needed, this size winch provides for a faster inhaul speed and draws less amperage for the typical pull than a lower rated capacity winch. A quick connect pigtail type fitting connects the battery and winch and the battery is also connected to the ATV alternator system. The ATV uses a 2" ball and receiver assembly for pulling the arch and a skid bar is used when conventional ground skidding is acceptable. The arch structure is attached to the horizontal trailer members just forward of the wheel axle. The main arch and trailer framework are made from 4" channel tubular steel. Hooks are welded onto the frame members so that the arch can be tied off to a stump if needed when winching. The cable fairlead used is from an RV application and the upper spool removed to allow sufficient width for the butt rigging to pass through the fairlead as needed to bring the front of the log into the arch cage. The choker system used for the arch utilizes a ring and tee design. Five-sixteenth inch steel cable is used for the bull line that has a metal tee attached on the en Each choker consists of a 3-5 foot length of cable having a steel ring in one end and hook on the other. Several chokers are put onto the bull line by slipping the rings over the tee and positioning them along the bull line as needed to attach logs or other slash/brush material. When all the chokers are attached, the operator engages the winch and pulls in the bull line. The tee forces all the rings on the chokers forwards towards the arch. The ends of the logs are brought into the arch framework thereby elevating the front end. The ATV can then be used to yard the logs to the landing. If a heavy load is hooked up or rough ground makes skidding difficult, the winch can be used to alternatively winch logs to the machine, free spool the winch, move the ATV ahead and winch again until normal skidding is possible. A tongue weight of 80-90 pounds is desired when pulling to maximize tractive effort and steerage. The arch is designed to accomplish this when the ATV starts pulling as the fairlead and pulley system are forward of the wheel axles effectively shifting a portion of the load weight onto the trailer tongue.

Fig 1. Yarding tanoak log with ATV- Lipfoot Arch skidding system.

The ATV-arch system has been used operationally for removing small logs and slash material resulting from pre-commercial thinning. Experience has shown that top production in this system is maintained by maximizing the ATV's capability for relatively high skidding speed. On a fairly smooth, firm surface, it is possible to yard material at 20-25 mph or more. This is where turn cycle time can significantly be reduced, especially on long skids. Since 1989 the average turn time has been 3.25 minutes with skid distances ranging up to 1500 feet. Maintaining this production requires careful consideration of turn size and skidding design. The most important turn size variable is log length followed by log diameter. Given similar terrain characteristics, a longer log will usually require more winching and positioning time to pull it to a skid road so as not to damage residual trees and not bind it between other trees. Relative to conventional tractor yarding, this system has much less pulling capability. Even when winching, a heavy log may pose sufficient yarding resistance such that the ATV is pulled towards the log if the machine itself is not tied off. This can be used advantageously when positioning the ATV for yarding in rough or debris covered ground or through heavy vegetative cover. By putting it in neutral, the ATV can be winched to the log in a very controlled fashion. Bucking a large log to a shorter length is usually more productive than having to do extensive winching. One of the largest logs Jim skidded was a white fir log that he calculated was 3500 pounds, 33' long and having end dimensions of 17" and 27". To skid it, he had to buck it in half and winch the two

resulting short logs up to the arch as there was too much ground resistance to pull it as one long log. He prefers yarding logs that are no more than 25' long and range between 16" and 22" on the small end. On one operation, 4 ATV's and a arch were able to yard enough wood material for chipping to fill a chip van daily. On another project, sufficient small logs were skidded per day to make 1.8 truck loads. Jim recommends not yarding material smaller than 1.5" diameter in thinning slash and not less than 3" branchwood for hauling to a chipper.

Based on a 8 month season and working 5 day weeks and replacing the machines every other season, the operating cost for the ATV has been $1.90 per hour. When maintenance costs are added in, the operating cost rises to $2.90 per hour. Initially, oil coolers were not installed on the machines and rings were being replaced every other month at a cost of $30 per set. Since installation of coolers, ring replacement has not been needed.

Safety is always an important issue regardless of the system that is being used. Unsafe actions to be recognized with this system are excessive speed on rough and/or debris covered terrain and sidehill usage. These increase the risk of machine tipover or pitching the operator off the machine. Winching operations are potentially hazardous, especially when yarding heavy logs. Jim emphasizes it is operator responsibility to survey and recognize the safety hazards and act accordingly. Operators should wear the appropriate safety apparel such as approved safety helmet, gloves and other protective clothing.

The usability and productivity of this system are primarily dependent on factors of terrain slope and roughness, depth and distribution of slash and type and size of material to be yarded. He does not recommend working this system simultaneously with feller- bunchers because of the difficulty of running the ATV over the generated debris. The best application is in a pre-logging operation where the ground is relatively clean and unroaded with skid trails. To date, Jim has not done uphill skidding using the ATV. He has winched logs uphill out of a draw and then skidded with the ATV on the level or downhill portion of the skid route. Using a "go-back" skidding design, Jim has worked on up to 60% slopes in other sites while the maximum slope encountered on our demo was 40-45%. In this application, the operator uses favorable terrain features or skid trails to keep the ATV fairly level from side to side to negotiate the slope when getting to the log to be yarded. At a safe terrain feature, the machine direction is turned downhill and the ATV is brought forward of the log and positioned for winching it into the arch. A different route is taken down the slope to the road or landing using the same principles for safe operation of the ATV.

Although it was not demonstrated, Jim also uses the ATV system without the arch component. He has skidded logs up to 12" (small end) diameter and 20' long using conventional type chokers. When skidding thinning slash type material, he stretches out a 12' choker, lays slash on top of it and chokes the material by bringing the end of the choker cable over the material and hooking it to the bell. Non-arch ground skidding production of lighter material is increased due to better mobility of the ATV without the arch and faster hook times. The principle use of this low impact logging system is on sites where the combination of materials, terrain and soils minimize the risk of soil compaction and erosion.

Fig 3. Parlin Fork Sawmill

Fig 2. Milling tanoak with Woodmizer portable mill.

HARDWOOD MILLING

The workshop examined the operations of portable mill and a larger stationary mill. Jack Boone demonstrated the use of his portable mill, and Jim Anderson gave a tour of the Parlin Fork Conservation mill. Jack uses a Wood-Mizer mill (fig 2.) mounted on a single axle trailer framework for towing behind a vehicle. It is a band saw powered by a 4 cylinder engine mounted high on the frame assembly also supporting the large diameter drive pulleys for the band saw. The band saw cuts on a horizontal plane with the saw being moved through the stationary log and generates a 1/16" sawkerf. The trailer frame acts as a platform for the log when it is picked up by two hydraulic actuated arms mounted under the trailer frame. When milling a large log, the initial difficulty is rolling the log onto the arms which lift the log onto the mill frame. On one large log that was to be milled, the Lipfoot arch was used to get the log onto the lifting arms by setting a choker further back on the log, pulling the front end of the log tight against the arch cage and using the winch to lift the whole log off the ground. Once on the frame, a hydraulic powered log turner arm was used to turn the log for positioning each cutting face. When the log was at the right position, a hydraulic powered dog was set up tight against the log to hold it in place while the cut was being made.

The Parlin Fork camp lumber mill (fig 3.) provided a fine example of a larger stationary mill setup with lumber drying facilities for the workshop. Parlin Fork Conservation Camp over the last year has assembled all the components of a sawmill acquired from the University of California Wood Products lab in Richmond. The sawmill unit was originally built by the Corley Manufacturing Company of Chattanooga, Tennessee and purchased by UC in 1955. The entire package consists of a right hand sawmill with a 52" circular saw blade, 52' track for the log carriage with single acting setworks, a log turner assembly and a 21" edger. The mill is powered by a 440 volt, 100 H.P. electric motor A diesel powered 150 kva generator is used to provide electrical power to the mill. Currently the mill is cutting approximately 10 mbf of hardwoods annually, with plans to increase production as facilities are developed.

Fig 4. Parlin Fork combination solar-wood fired lumber dryer

Lumber Drying at Parlin Fork

The last stop was at tour of the drying facilities at the Parlin Fork mill yard. The hardwood logs being milled at the Parlin Mill typically have a moisture content (MC) of 70 percent. To be usable for furniture stock or other high quality products, green lumber must be dried to so that the final MC is 6%-8%. Lumber dried to this state has stable dimension, machines smoother, and has a stronger glue bond . Two methods are used at Parlin Fork to dry their green lumber down to this point. The first system used is shed drying which brings the MC down to about 25 percent in eight to ten months. Between 6-8 thousand board feet of lumber is stacked in a well-ventilated shed to protect the lumber from direct rain and sun. Each layer of lumber is separated by 1" thick wood stickers on a 1' spacing so that air can circulate through the stacked lumber to carry away the moisture from the lumber surface. This close sticker spacing reduces the risk of lumber degrade from warpage during this relatively uncontrolled air drying period. As Greg Downer pointed out it is also very important to stack the lumber so all the ends are even which maintains a similar air environment around the ends, again reducing the risk of degrade in the boards due to checking and warpage. A combination solar and wood fired kiln drying system (fig 4) is also used which brings the lumber moisture content down to the desired 6-8 percent MC. An exterior woodstove using mill waste for fuel is connected to the kiln using rectangular steel tubing to raise the kiln temperature as desired. A solar panel is mounted on top of the shed peak to power two small air circulation fans. The kiln can hold about a 500 board foot charge and takes about 1-2 months to bring the lumber to the desired MC. The kiln dried lumber is ready for delivery at this point. All the hardwood lumber produced at Parlin Fork is normally already ordered so the lumber normally does not have to be warehoused at Parlin. Several other conservation camps have carpentry shops that have an ongoing need for hardwood lumber and other state facilities can also order this lumber.

PACIFIC COAST HARDWOODS CONFERENCE HELD IN UKIAH AND JDSF

A two day conference sponsered by University of California Forest Products Laboratory and Mendocino College was held on June 2-3, 1994. Dr. John Shelly , wood technologist at the Lab , initiated the conference and was one of nine speakers on the first day addressing various topics such as history, characteristics and properties of the resource, economics, job creation, marketing and milling and products. The second day was spent at both Bruce Burton's mill, observing his operation and then traveling on to Jackson Demonstration State Forest. Near Parlin Fork Conservation Camp, management of a mixed hardwood and conifer stand was discussed, hardwood milling and drying operations were viewed and at Chamberlain Conservation Camp fine hardwood furniture products made from Parlin Fork milled hardwood lumber were observed.

SEMPERVIRENS

By Bill Baxter- JDSF Silviculturist

The journey from seedling to mature tree need not be difficult, especially for coast redwood with its tremendous growth potential. However, any long journey begins with the first steps and these are very important ones for coast redwood. Although shade tolerant in terms of survival, coast redwood is not very shade tolerant in terms of satisfactory growth. Foresters need to control the environment surrounding the seedlings to foster growth and seedling vigor. This action is crucial if one expects planted seedlings to develop into mature trees within any reasonable planning horizon.

Jackson Demonstration State Forest has implemented three different types of vegetation prescriptions during this past year. The purpose of these treatments is to create an environment more conducive to the establishment and growth of redwood and Douglas-fir seedlings. These projects were conducted on an operational basis, and will be the subject of this issue of Sempervirens.

Reforestation Strategies

Vegetation management prescriptions have little meaning unless the proposed treatments are framed within a larger perspective of how timber stands will be intensively managed. One of the goals of the state forest is to optimize the sustained yield of high quality sawtimber. The long term reforestation strategy on the State Forest depends heavily on the ability of coast redwoods to reproduce by sprouts. The use of various coppice silviculture methods will increase in value as the distribution of coast redwood stems becomes more uniform within each stand. The cur-

rent distribution of coast redwood stems is uneven and clumpy within unmanaged stands, and so our reforestation strategy commonly includes using artificial regeneration methods to establish a more uniform spatial distribution of stems.

Our intent is to ensure a good distribution of redwood stems in the current young stand, since the spacing of these trees will dictate the spacing in future generations of sprouts. The State Forest can then rely more on natural regeneration from well distributed sprouting redwoods in the future as the Forest becomes regulated.

Maintaining Seedling Vigor

There are three important requirements related to maintaining seedling vigor. First is the need to have quality seedlings which are well adapted to the site. The State Forest uses seed from the proper seed zone and elevation for all of its seedling orders. Proper attention to forest genetics is vital because the stand we are establishing is a long term, multi-rotational investment.

Secondly, maintaining healthy seedlings also means using the right type and size of planting stock. Coast redwoods are not known to naturally regenerate very well by seed and so the State Forest relies on artificial regeneration methods for the establishment of the redwood grid. The State Forest has had its best success using plug-1 (transplanted container stock grown for an extra year) and styro-#8 (8 cubic inch containers) coast redwood seedlings. These two stock types have good stem caliper and significantly more crown and root development than the styro-#5 stock. We generally inter-plant 200 to 300 seedlings per acre depending on the existing redwood stem distribution at the time of harvest. The species mix planted is commonly 60 percent coast redwood and 40 percent Douglas-fir.

Fig 1. Results of a directed spot application. This plug-1 coastredwood has been in the ground for two growing seasons. Noticethe wall of brush just outside the three foot radius treated area.

The third requirement is encouraging immediate seedling development by reducing other plant competition as much as possible. Redwood sprouts will generally dominate over most other types of forest vegetation during the first 20-30 years of stand development, but redwood seedlings often need some kind of assistance. Valuable time and growth will be lost if the seedling is forced to compete in an understory of heavy brush. This is especially true if one is counting on redwood seedlings developing into future crop trees during the first rotational period following planting.

Vegetation Mgt. Strategy

Vegetation management prescriptions have been developed in part so that the planted seedlings will have the opportunity to express dominance as quickly as possible. Controlling the competing vegetation early in the stand development provides two potentially very positive outcomes. The first is that foresters have the opportunity to select future potential crop trees much earlier in the stand development. This should result in better growth on the selected crop trees over the rotational period. Secondly, foresters could potentially save money on precommercial thinning costs. Providing the opportunity for the planted seedlings to express their dominance quicker allows for the stand to be thinned much earlier in the time line of stand development. The savings result primarily from being able to pre-commercially thin the sprout clumps earlier in their development. Due to the redwood sprout's comparatively rapid growth and development pattern, it becomes significantly more difficult and costly to thin these clumps each year thinning is delayed.

Current management strategy in stand development includes a precommercial thinning early in the stand's development. The timing of such depends on 1) when planted seedlings have grown large enough to express dominance, and 2) the residual thinned sprouts being large enough to maintain enough of the living root system of the original stump.

Integrated Pest Mgt.

Jackson Demonstration State Forest uses integrated pest management techniques when managing forest vegetation. Three prescriptions using herbicides are described. However, a wide array of different possible techniques were considered during the planning stages of each project, e.g. burn/no burn, chain saw release, and mechanical release. Recently, for example, the State Forest contracted for chain saw release during a precommercial thinning operation. All vegetation management prescriptions are developed on the State Forest with the assistance of a licensed Pest Control Adviser (P.C.A.).

These vegetation management prescriptions are working well for the mix of vegetation and environmental conditions found on the State Forest. However, these prescriptions should not be used as a cook book approach for all vegetation control problems. Each forester or landowner will need to consult a P.C.A. during the planning stages of any vegetation control project which involves the use of herbicides. This article will hopefully build a foundation for how these possible discussions between P.C.A.s and foresters/landowners might begin. In this context I would like to describe our three vegetation management prescriptions.

1. DIRECTED SPOT APPLICATION

This prescription is designed to provide each planted seedling a 36 inch radius space which is relatively free from other competing vegetation (fig 1). The State Forest attempts to conduct this treatment as soon as possible after tree planting is completed. The treated area consists of a 36 inch radius circle around each planted seedling. The prescription includes application of a pre-emergent herbicide (atrazine) to control grasses and brush species before they germinate. Atrazine is also effective on existing grass if it is still actively growing. Atrazine is a soil active herbicide, and ap-

pears to remain effective in controlling vegetation for at least two years after the application is made. This herbicide needs to be applied early enough in the season to have sufficient rainfall to move it down into the rooting zone of the soil profile. The amount of rainfall needed depends on the depth of the rooting zone and the texture of the soil. The State Forest has applied atrazine during the months of January, February and March over the last two years, and the results to date are impressive.

Fig 2. Looking over harvest unit J which was treated in 1993 with a directed broadcast treatment

Triclopyr (Garlon 4®) and a surfactant have been included in the spray mix when brush germinants are observed above the soil surface. Triclopyr is labeled for use as a foliar active herbicide, and need not be added to the spray mix if brush seed has not germinated within the area to be treated. Triclopyr is effective in controlling blue blossom ceanothus, french broom, coyote brush, huckleberry, and tanoak. This herbicide does not appear effective in controlling manzanita when applied as a foliar spray.

The following directed spot spray mix has been used on the State Forest with success when brush germinants were already present on site around the planted seedlings:

A) 1% (by volume) atrazine (AAtrix® Nine-0); B) 1% (by volume) triclopyr-ester (Garlon 4®); C) 1/2% (by volume) surfactant (Mor-act®, Activator 90® or equivalent); D) Sufficient concentration of a compatible agricultural dye (Colorfast Red® or equivalent) to visibly mark treated area; E) In clean water. The water supply must be clean so that the efficiency of the herbicide is not reduced. The spray mix was applied at a rate which lighly moistened the top of the soil, and where the agricultural dye color was visible. This equates to approximately 25 to 35 gallons/acre of applied mix within the treated circles.

Coast redwood and Douglas-fir seedlings do not appear to be easily damaged by this spray mix if the treatment is conducted before bud swell and bud break. Seedling terminal buds have begun active growth generally on or after March 15th during the last two years on the State Forest. Once active seedling growth has begun, these conifer species appear very sensitive to damage by this mix. However, for the best result, care should always be exercised to minimize treatment of non-targeted vegetation. The contractor is required to protect seedlings during directed spot spraying operations on the State Forest and some have used a plastic shielding device to do so.

This prescription has been very effective in controlling targeted brush and grass species. There is generally a wall of vegetation just outside the treated area two years after treatment, while the treated area is generally free of competing vegetation. Both coast redwood and Douglas-fir seedlings have responded well to this favorable free to grow environment. These planted seedlings have full healthy crowns and range from 2.5 to 4 feet in height two years after planting.

Having a cleared area around each planted seedling also provides much better access if follow-up vegetation treatments are required. The non-targeted vegetation (future crop trees) is also easier to locate and avoid when treating the larger brush located outside the 36 inch radius circle.

One potential negative impact of this treatment may be that the Douglas-fir seedlings are more at risk to deer browse. However this does not seem to be a problem currently.

2. DIRECTED-BROADCAST APPLICATION

The State Forest uses site preparation broadcast burning as a tool to provide physical access for planting operations when slash depths and densities from logging make it too difficult for planters to find suitable planting sites. The negative side effect of burning is the predictable site occupancy of blue blossom ceanothus and other brush species following the fire. The seed of ceanothus, manzanita, and other brush species can lay dormant in the forest soil for hundreds of years. Fire acts as an agent to break the hard seed coat, which allows enough moisture to enter the seed for germination and growth to begin. This invasion of the site by brush can easily out compete planted conifer seedlings.

The term directed-broadcast has been used to mean that the spray mix is directed away from visible desired conifers and broadcast throughout all remaining areas with competing brush species where control is desired. The following foliar spray mix has been used during the past two years with a high degree of success in controlling ceanothus, french broom, and tan oak: A) 1% (by volume) triclopyr-ester (Garlon 4®); B) 1/2% (by volume) surfactant (Mor-act®, Activator 90®, or equivalent) labeled to augment penetration and wetting; C) and sufficient concentration of a compatible agricultural dye (Colorfast Red® or equivalent); D) in clean water. The water supply must be clean so that the efficiency of the herbicide is not reduced. This spray mix has not been effective in controlling manzanita.

The timing of the application has been influenced by two variables. The first is the time after burning necessary for vegetation to develop certain characteristics. The goal is to treat targeted brush species when they are between knee and waist high. This height is generally reached during the second spring season following a fall burn, which is usually equal to three years following the actual logging operations. One wants to 1) allow time for most, if not all, the brush seed to germinate and grow before beginning treatment; 2) treat the brush before it exceeds shoulder high (limit of what one can safely foliar spray vegetation as a ground application) and 3) Allow the tanoak sprouts to develop sufficient leaf surface area so that enough herbicide can be translocated into the root crown to kill the plant. If one treats tanoak sprouts any sooner than three years after felling the original tree, the herbicide will generally just brown the foliage without killing the root system. Leaving the root

Fig 3. Example of planted seedling to be released with a conventional basal bark treatment.

system intact will allow new tanoak sprouts to develop from the living root crown.

The second variable deals will protecting planted seedlings from damage from the herbicide application. Most of the State Forest plantations did not receive a timely directed spot treatment, and thus most of our planted seedlings are overtopped by the competing brush two to three years following a broadcast burn. Now the directed broadcast spray must be applied to thoroughly wet all foliar surfaces of competing woody vegetation, including the interior portions of their live crowns, for this treatment to be effective.

The concern was that many of the overtopped planted seedlings would be inadvertently treated due to the extensive brush cover and the need to thoroughly treat all foliar surfaces. The solution was to treat the vegetation while the brush was beginning growth but before planted conifer seedlings had broken bud (begun active growth). The terminal buds will begin to swell before active growth is initiated. The State Forest has had success in protecting seedlings by spraying during the seedling dormant period prior to March 15th. Some minor amount of conifer damage was observed following treatment, however the amount of damage did not appear to be significant. The contractor was additionally directed to avoid treating conifers where they were visible in the brush canopy.

The question is frequently raised whether it is better to aerially spray or ground apply with backpack sprayers. The State Forest only ground applies this type of spray mix because of the need to thoroughly treat all foliar surfaces. Spraying by air does not provide for a thorough wetting of all foliar surfaces. We have observed many examples where just a branch was missed during treatment, and the targeted plant remained alive following treatment.

The results of this prescription have also been impressive. This treatment has effectively controlled ceanothus, french broom, coyote brush, and tanoak. The brush canopy is now breaking down on units treated in 1993 and allowing increasing amounts of light to reach the planted seedlings. The planted seedlings are responding by developing larger crowns and increasing their internode lengths on terminal leaders (evidence of increasing tree vigor). Planted seedling are expected to emerge from the dead brush canopy within two to three years following the directed broadcast treatment. The next treatment should be a precommercial thinning in seven to ten years.

Treatment effects do take time to become apparent. The first observed result was a slight leaf curl and a slight change in color on the blue blossom ceanothus. Total mortality of the targeted brush species was observed around mid May (two months following directed broadcast spraying).

3. BASAL BARK APPLICATION

What options do you have when you can barely crawl under dense, tall brush with large stem caliper and you notice that your planted seedlings are still living? The last prescription, basal bark treatment, is meant to address this situation. This treatment is very effective in controlling ceanothus, manzanita, french broom, coyote brush, and younger tanoak stems. We have found that this treatment can be conducted at any time of the year, as long as the bark surface is dry. The height of the brush is not the limiting factor because only 6 to 12 inches of the stem (just above the ground) is treated.

The treatment consists of using back pack sprayers and treating each individual stem with the following application mix: A) 3% (by volume) triclopyr-ester (Garlon 4®); B) 97% (by volume) kerosene (Other possible carriers include Mor-act® and Penevator®); C) and sufficient concentration of compatible agricultural dye (Color Fast®, Trail Blazer®, Nu-gro Red®, or equivalent).

If the stem is less than one inch in diameter at ground level, only the first six inches of the stem above the ground needs to be treated. If the stem is greater than one inch in diameter at ground level, then the first twelve inches above the ground must be treated. The treated surface needs to completely wrap the stem for this treatment to be effective. Some carriers and nozzle jets provide for better wraps than others. One needs to apply enough chemical to wet the bark surface so that it runs down to the root collar.

This treatment has been very effective in controlling brush in areas I once thought unfeasible to treat (too dense, tall, and steep to be cost effective for treatment). If you have seedlings still capable of release, then this treatment should be evaluated as a part of your possible options. This treatment is also effective on smaller brush sizes, especially if manzanita makes up a significant part of your species mix to be controlled.

The prescriptions described were developed with professionalism and assistance of the following individuals. A special note of thanks goes to; Robert Brenton, Bernie Bush Walt Decker , Robert Nelson, Ina Silverwood, Jeff Wadsworth, Scott Warner and Randy McDaniels .

Disclaimer: The mention of trade names or commercial products in this article does not constitute endorsement nor recommendation for their use.

CALIFORNIA FOREST PEST COUNCIL TOUR TO BE HELD ON JACKSON STATE FOREST.

This year's California Forest Pest Council Weed Tour (July 27 - 28, 1994) is going to be conducted in part on the State Forest. This tour will provide you an excellent opportunity to view each of the prescriptions described in the Sempervirens column. To place your name on the mailing list for information regarding this tour, please write to Flemming Badenfort, P.O. Box 340, Calpella, CA 95418.

JDSF HOSTS COAST REDWOOD FOREST MGT. SILVICULTURE CONFERENCE

Forestry professionals from academia, private industry and state and federal government met at Fort Bragg at the request of JDSF staff to identify and prioritize informational needs related to integrated resource management/silviculture topic for the coast redwood type. Other discussions centered on possible funding sources for research projects and initial discussion and planning for a coast redwood symposium. The two day meeting was held on January 6-7, 1994 with a first day field tour on JDSF and the second day meeting at the Tradewinds Conference center.

Thirty-one research areas were identified through a facilitated brainstorming process and the resulting compilation (shown in next two columns) was then further refined through an interactive process involving the entire group of participants. Each conference participant was allowed to choose five topics he or she felt to be the highest priority in terms of future coast redwood research. The highest seven scored topics were then selected for further development by the group.

Participants were then divided into seven groups and given the assignment to further define the topic by developing the following points. 1.) Needs Statement - expanded discussion of the information need; 2.) Value or Significance; 3.) Hypothesis; 4.) Location/where/who if known; 5.) Funding (how to if known); 6.) Length of project; 7.) Leaders - list of individuals who are interested in this research project and who would be available to give further direction on how the project might be carried out if requested.

Some of the important issues on each topic are described here. More detailed information may be obtained from Bill Baxter or Norm Henry, JDSF staff (707/964-5674), or John LeBlanc, ESPM Extension Forestry, University of California, Berkeley (510/642-2360).

1. Dynamics of Group Selection

This system is perceived to have benefits of both even and un-even aged management in terms of stand development, wildlife habitat, and harvesting efficiency. From a silvicultural perspective, this technique mimics a clearcut while still maintaining a relatively forested landscape. Some of the information needs include:

- How is stand development influenced by the size, shape, aspect, slope and distribution of openings?
- How should groups be located and logging plans (including road locations) be designed to minimize damaging regenerated groups in successive re-entries?
- How to most accurately and efficiently inventory stand attributes under this type of silviculture?
- What is appropriate for intermediate entries in regenerating groups to maintain stocking control, hardwood/brush control?
- What are the influences on wildlife (quantity and diversity) and wildlife habitat?

2. Riparian & Aquatic Resource Mgt.

Forest owners/managers have obligations in this area which include maintenance, restoration and enhancement of these resources. Riparian areas provides 1) in-stream structural elements for habitat health and stability; 2) habitat for riparian dependent species; 3) refuge and migration corridors for terrestrial wildlife species; 4.) protection for water quality from activity related impacts upslope from the water course.

Can we use watercourse/riparian areas as a measure of landscape health & integrity? Can one integrate timber production with the protection of riparian resources? What are the costs and opportunities foregone at each level of increased protection?

3. Spatial Dynamics of Stand Structure

Silviculture oriented to attaining a broad variety of resource values other than timber production will require new approaches to inventory, modelling, stand description, and understanding of wildlife/habitat relationships. New methods need to be developed for describing uneven-aged structures at the landscape level. Techniques to quantitatively describe the horizontal and vertical structure of stands that avoid reliance on stand averages are needed.

4. Redwood Forest Type Growth Modeling (Young Trees)

Foresters need the ability to predict how young (1 to 30 years old) redwood forests grow, and what the growth potentials really are for managed forest timber stands. Specifically what is being lost by having understocked or overstocked timber stands. The model needs to include the following species: Coast Redwood, Douglas-fir, Grand fir, Tan Oak, and common Brush Species. Information is needed on which variables are important in influencing early growth of redwood forests. Some of the initial variables to be evaluated are micro-site, vegetation competition, sprouts versus seedlings, site, and genetics. The model needs to be interactive in nature so that forester can better plan stocking and brush control treatments (precommercial thinning, and vegetation management). It should be able to handle mixed sizes of conifers (unevenaged forestry), and allow ways to include ingrowth into the projections and it's output needs to be compatible with CRYPTOS files.

5. Demonstration of Uneven-Aged Forestry

There is great political pressure to manage uneven-aged forests on a demonstrable sustainable basis. This type of project would help show whether biologically diverse redwood ecosystems can be sustained under uneven-aged management (for a long time period & across the landscape). What defines "sustainability " and what are the criteria which can be measured to prove sustainability? What ecosystem elements are sustainable over the long run?

6. Documentation of Mgt. Alternatives & Activities on JDSF (including economic and financial data)

Making full use of existing studies or data bases for technology transfer and best use of new research funding requires having good documentation for them. It was proposed that standardized methodologies for silvicultural demonstration and research studies be developed at the Forest. A checklist of key elements such as economic & financial data, water quality/quantity data, associated flora/fauna, soil impacts, forest/stand attributes, and productivity should be incorporated if possible into such documentation.

7. Document & Synthesize Existing Information On Coast Redwood Forests

In the same line as topic six it is just as important to find and document existing information from other sources such as State, Federal, & University studies started

& abandoned, or not published; studies in progress where project leader may soon leave or has left; private studies and/or experience which may not be confidential in nature. A central library or clearing house needs to be established to collect & disseminate information so that we do not "reinvent the wheel."

Funding /Symposium for Coast Redwood Research

The second task during day two focused on the establishment of a potential North Coast cooperative funding source for integrated resource management/silviculture projects conducted on Jackson Demonstration State Forest (and potentially other research facilities related to the study of coast redwoods). Some of the suggestions included using an existing organization such as the California Forest Research Association whose legal framework already established. Other possible sources would include grants, product surcharge tax monies, forest industry funding, Yield Tax source, California Forest Products Council, State Budget Proposal, and Option 9 Funds. One possibility is also to develop a Coop Advisory Committee on the State Forest to help direct funds and projects.

The final task consisted of discussing the concept of holding a Coast Redwood Symposium in late 1995, and describing the steps necessary to make such an event happen. The symposium would need to be interdisciplinary in scope with a focus on ecosystems. A steering committee was appointed to develop the initial organization to proceed on this concept.

CLOSING COMMENTS

Professor John Helms, University of California, Berkeley closed saying that the forestry profession is facing a crises in land management. The public is greatly concerned with how wildlands are being managed. Specific concerns include the integrity and appearance of the landscape as well as the sustainability of the management system and the forestry profession must be attentive to all three above. Second, the profession is facing a crises in budget and forming partnerships will be essential to move forward as a profession. JDSF has a strong role to play in future coast redwood research.

Blue Gum (Eucalyptus globulus) tree improvement project

During the spring of 1993, seed was collected from ten blue gum trees on Jackson Demonstration State Forest and many other sites on the north coast as part of a joint project between PSW-Institute of Forest Genetics and a Chilean paper company (a Shell Petroleum Company subsidiary). The objective is to develop a more frost resistant, rapid growing blue gum for fuel biomass and paper pulp in California and Chile.

According to Thomas Ledig, a senior scientist at the Institute who is directing the project for PSW, additional fuel wood and hardwood fiber is needed in California due to steep increases in fuel biomass costs. These cost increases have come about primarily from new wood-burning power generating stations being placed in operation which has increased the demand for wood fuels. Hardwood fiber is also needed in the manufacture of upper-grade paper stock such as photocopy paper.

Tom enquired about getting seed from a site on the west end of the Forest which had been planted around 1895 with blue gum as part of windbreak a apple orchard (State Forest Note 57). This 65 acre orchard was used for providing fruit for some of the historic logging camps on Caspar Lumber Company lands. The original one acre planting of blue gum along the edge of the orchard has expanded to well over 50 acres today due to its prolific seeding. As our management goal is to convert the land back to conifer production we had no problem for felling of selected trees their research. Roger Stutts, Forestry Research Technician and several assistants came over to make the selection and obtain the cones.

The project design uses conventional tree breeding methodology. The trees from the various sites are selected based on visual characteristics such as bole straightness and branching characteristics. The trees are felled and the seed is collected to grow the progeny in replicated tests. These tests will measure which parents produce the most rapidly growing, straightest and frost resistant trees. The last step is to select the best of the progeny groups (families) and the best individuals within the families for operational propagation.

The first stage of the project was started when 10 trees were selected for seed collection at Caspar Orchard on JDSF. Seed was collected from several other sites during that time period. A similar number of trees (40) will also be collected in Chile by another Shell subsidiary.

The Institute and Shell will then exchange sufficient seed to establish a series of progeny tests, each having 80 families (40 each from California and Chile). Two progeny tests of about four acres each will be installed in California; one near Concord and one near Arvin. Shell will plant at least four tests in Chile.

A combined analysis of the Californian and Chilean tests will indicate whether selections made in one country can be usefully planted in the other country. The tests will also provide statistical data that can be used in planning further tree improvement efforts in blue gum by documenting how much gain can be made by breeding and what are feasible economic choices among alternate breeding plans.

The progeny tests were planned for installation two months ago (March) in California. The Chilean plantings were supposed to have been planted last October. Meaningful results on growth rate and form should be available by the year 2000 as blue gum is fast growing species.

FOOT BRIDGE INSTALLED AT CAMP 20

As part of the development of the recreation and interpretive area at Camp 20, a 6 foot wide by 85 foot long footbridge spanning Chamberlain Creek was installed on January 27, 1994. This culminated over a two year process to get the necessary engineering completed, site prepared and arrange all the other logistical tasks.

The footbridge idea was originally conceived as we started planning the arboretum development which is sited diagnonally across Highway 20 from the visitors kiosk area. Having this footbridge plus an undercrossing at the Chamberlain Creek highway bridge would allow people to park at the kiosk area and walk over to the Arboretum area or to the little red schoolhouse. This was an important ele-

ment as parking is very limited except at the kiosk site.

Through the state's normal purchasing procedures, the low bid to design, fabricate and deliver the bridge was made by Hallsten Supply Company, located in Sacramento. This company designs and prefabricates steel and aluminum structures with an emphasis in spanning type structures. The structural design which we specified is a steel half-through truss low profile design. Hallsten's bridge line meeting these criteria is called a LITE-SPAN™ bridge. We selected the self - weathering steel (CorTen) as it forms a corrosion resistant surface without having to paint it and maintain the finish.

The bridge parallels the highway bridge at Chamberlain Creek and is offset to the south by about 15 feet. Since the banks were at different elevations we engineered the bridge footings so that the walking surface had no more than the maximum allowed handicap slope of 1 in 12 (8.33%).

The bridge abutment I shaped design provided by CDF engineering staff at Sacramento proved to be a real challenge to build. Thanks to a lot of hard work by region engineer Mac McWilliams and Conservation Camp crews from Chamberlain Creek, an earth form was sited and hand dug at each side to accept all the necessary rebar in preparation for the cement pour. All of the rebar was shaped and sized to the proper configuration at Chamberlain camp prior to being assembled and tied in the earth forms on site. We had purchased transit mix for the pour and also used a concrete pumper on the east side.

The big day occurred when the bridge was delivered. Hallsten had built the bridge in one section so we knew they had to traverse the steep and sharp curves on Highway 20 as it descends down to James Creek with this 85 foot long bridge. They assurred us that it could be done with their special trailer-steerable dolly and they did arrive on time the day before the installation. That same afternoon, Daniel Steel delivered their 75 ton hydro crane to the site for the next days "pick". The next day ended up being much longer as the original spot for the crane proved to be too soft because of recent rains to support the tremendous weight imposed on it. We were able to spot the crane on the highway properly blocked just off the highway bridge thanks to the cooperative CalTrans permit inspectors. The actual lift took less than one hour and everyone was very relieved when the bridge plates fit onto the abutment anchor bolts with just a minor bit of adjustment.

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